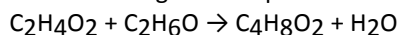


TAD04 – A5 IB Practice

Name.....

1. This question is about the three organic compounds involved in the following reaction.



W **X** **Y**

- (a) The infrared spectra of all three compounds showed several absorptions. Describe what happens on a molecular level when molecules absorb infrared radiation.
- (b) Use the following information about their infrared spectra to deduce which bonds are present in the three compounds.

All three compounds showed an absorption close to 1200 cm^{-1} .

There were broad absorptions in both **W** and **X**. The one in **W** was centered around 3000 cm^{-1} , and in **X** around 3400 cm^{-1} .

Compounds **W** and **Y** showed absorptions close to 1700 cm^{-1} .

bonds in **W**

bonds in **X**

bonds in **Y**

- (c) The ^1H NMR spectra of the three compounds were available. State what can be deduced from each of the following.

(i) The presence of **two** peaks in the spectrum of **W**.

(ii) The presence of a triplet and a quartet, with areas in the ratio 3:2, respectively, in the spectra of both **X** and **Y**.

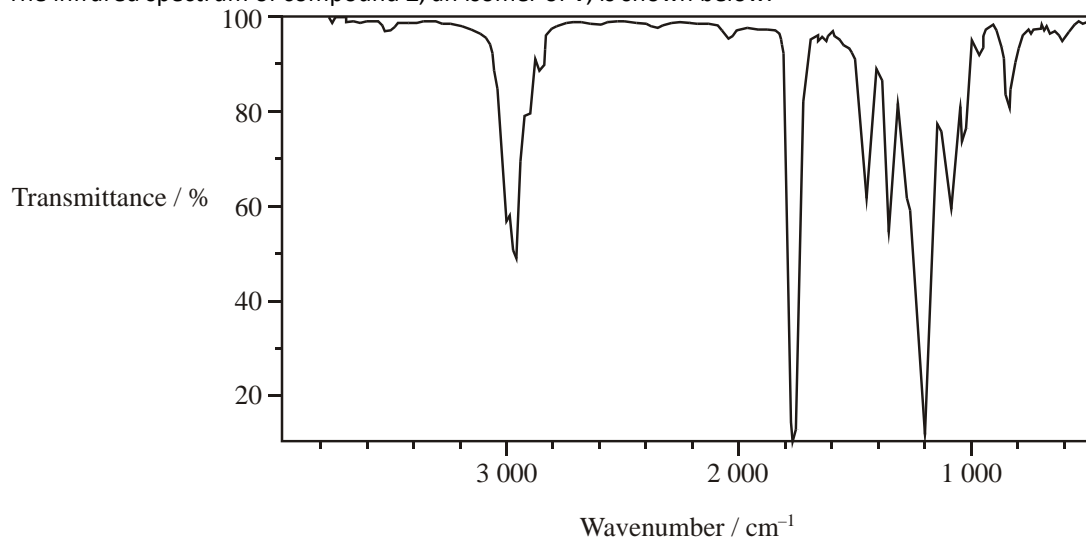
- (d) Use your answers to (b) and (c) to deduce the structures of the three compounds.

W

X

Y

- (e) The infrared spectrum of compound **Z**, an isomer of **Y**, is shown below.



- (i) Estimate the wavenumber values of the **three** most prominent absorptions in this spectrum and suggest which bonds are responsible for them.

absorption 1
absorption 2
absorption 3

(3)

- (ii) Deduce the structure of **Z**.

(1)

(Total 15 marks)

2. (a) ^1H NMR spectroscopy can be used to obtain information about the structure of molecules. State the information that can be obtained from the

- (i) number of peaks.

(1)

- (ii) chemical shift.

(1)

- (iii) ratio of peak areas.

(1)

- (iv) splitting pattern.

(1)

- (b) The ^1H NMR spectrum of a compound with the formula $\text{C}_4\text{H}_8\text{O}_2$ exhibits three major peaks with chemical shifts, areas and splitting patterns given below.

chemical shift / ppm	peak area	splitting pattern
0.9	3	triplet
2.0	2	quartet
4.1	3	singlet

Using information from Table 19 in the Data Booklet, determine the types of proton present in the molecule.

(3)

- (c) Deduce a structure consistent with the information indicated in (b). Explain your answer.

(5)

(Total 12 marks)